

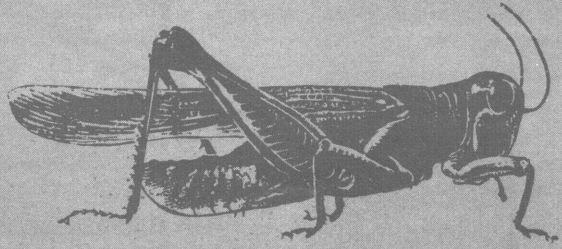
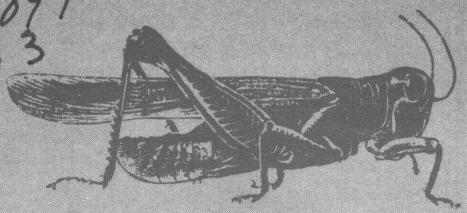
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Grasshopper Control

Grasshopper Control



*Prepared by Entomology Research Division and Plant Pest Control Division,
Agricultural Research Service*

Grasshoppers have brought fear and famine at one time or another to every continent of the world. On this continent, they attacked the scant crops of the Massachusetts Colony as early as 1740.

There are a number of species of grasshoppers in the United States. The pests are found in every part of the country, but serious outbreaks seldom develop in the East; they occur mostly in the western two-thirds of the country.

Grasshoppers often severely damage range grasses, and cultivated

crops including alfalfa, corn, small grains, and flax. They also contribute to soil erosion and "dust-bowl" conditions. Their overgrazing is one of the principal reasons for loss of productive grasslands in many States. They cause millions of dollars' worth of damage every year.

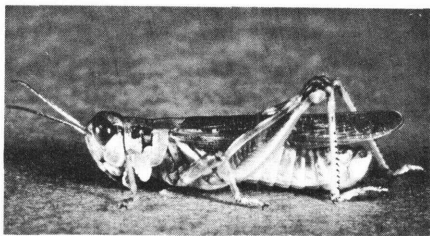
Grasshoppers can be kept under satisfactory control by applying insecticide. In areas where farming practices will permit, they can be controlled to some extent by using cultural measures.

USING INSECTICIDE

You may control grasshoppers by applying insecticide in the form of spray, dust, or bait.

Sprays give higher initial kills than dusts, and continue to kill over a longer period of time; they require less insecticide per acre.

Baits have largely been replaced by sprays, but baits are still used to control grasshoppers in fall-seeded



BN-17623-X

The migratory grasshopper, *Melanoplus sanguinipes*; probably the most widespread of all grasshopper species.



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Grasshoppers sometimes gather in swarms and migrate hundreds of miles.

grains when the plants are only a few inches tall. Under these conditions, sprayed leaf surfaces are not large enough to stop migrations of grasshoppers from adjacent untreated vegetation.

Types of Insecticide

Different insecticides have different properties. It is well to consider this and select the chemical best suited for your requirements.

One group of insecticides that control grasshoppers is known as *chlorinated hydrocarbons*. It includes aldrin, chlordane, dieldrin, heptachlor, and toxaphene. These chemicals are very effective, but they may leave residues on crops

and pasture forage; they must be used with caution.

A second group, called *organophosphates*, includes diazinon, naled, malathion, and Phosdrin. These are also highly effective and, if properly used, will not leave harmful residues. However, their killing properties do not last as long as those of the first group.

A third group is called *carbamates*, of which carbaryl is the most widely known. Carbaryl has about the same residual life as the organophosphates but is much less hazardous to the person applying it.

Sprays and Dusts

Emulsifiable concentrates, wettable powders, and dusts are obtain-

able in various strengths from insecticide dealers.

In preparing sprays, the emulsifiable concentrates or wettable powders should be mixed with a sufficient amount of water to insure that your spraying equipment will deliver the desired amount of active ingredient per acre.

Before applying a spray or dust, read the instructions that follow under "Dosages" and "Application procedures," and observe the restrictions given.

Dosages

Refer to the accompanying table, which shows insecticides to apply for grasshopper control, and dosage per acre.

If you are applying a dust, use the high dosages shown in the table.

If you are applying a spray, use the low dosages to kill young grasshoppers in short, dense, succulent vegetation and on open stands of

taller growth where long-continued killing action is not essential.

Use up to the high dosages for sprays when vegetation is tall and dense, or when the grasshoppers are adults. If it is necessary to control young grasshoppers before the main hatch is completed, the high dosages may extend residual action long enough to kill the rest of the hatch; this may save the cost of a second treatment.

The high dosages for sprays may be needed also in the treatment of

Insecticides to apply in sprays or dusts to control grasshoppers, and dosage per acre

Insecticide ¹	Dosage (amount of active ingredient) to apply per acre ²
<i>Chlorinated hydrocarbons</i>	
Aldrin.....	2 to 3 ounces
Chlordane.....	½ to 1 pound
Dieldrin.....	½ to 2 ounces
Heptachlor.....	2 to 3 ounces
Toxaphene.....	1 to 1½ pounds
<i>Organophosphates</i>	
Diazinon.....	8 to 12 ounces
Naled.....	8 to 12 ounces
Malathion.....	12 to 16 ounces
Phosdrin.....	4 to 8 ounces
<i>Carbamate</i>	
Carbaryl.....	8 to 12 ounces

¹ Do not use the chlorinated hydrocarbons to control grasshoppers on alfalfa. Do not use heptachlor or naled on corn or small grains. Do not use diazinon or carbaryl on small grains.

² Refer to recommendations under "Dosages" for use of low to high amounts of active ingredient.

DOSAGE RECOMMENDATIONS

The dosages recommended are based on performance in experiments and in general use. They should not be expected to cover all local conditions within the many States where grasshopper control is needed. They are offered as a guide to help you solve your own problems. If you are in doubt, consult your county agricultural agent or one of your Extension or State entomologists.

barrier strips, or for late-season use when vegetation is maturing, temperatures are high, and grasshoppers are fully grown.

Application procedures

The recommended insecticides are most effective when applied evenly, at the right time, and in the right place. They may be applied with ground sprayers or dusters, or by aircraft.

Application equipment should be carefully adjusted to give the desired rate of output. Too much insecticide is wasteful, and increases the danger of harmful residues. Too little insecticide is also wasteful because it will not prevent crop losses; areas treated with less-than-effective dosages will need to be re-treated if control is to be obtained.

If you use the insecticides in the table, proceed as follows:

Location of infestations.—Determine the location of threatening infestations of young grasshoppers in relation to the location of your fields planted to crops. Look along roadsides, canal banks, and field margins, in idle areas bordering cultivated fields, and in the fields themselves.

Spray or dust these places when the main hatch is completed or when the young grasshoppers begin to move off the hatching grounds. This early treatment will greatly reduce the amount of acreage that otherwise might have to be treated later. Grasshoppers that damage row crops usually hatch in field margins. Timely treatment of vegetation in these margins will destroy the pests before they move into the fields.

Corn protection.—To prevent grasshoppers from damaging corn, treat the margins of cornfields and



EPQ-1350

Mist blower mounted on a truck for use in grasshopper control.

adjacent infested small-grain fields or weed patches when the small grains begin to mature, before the grasshoppers begin to move into the corn.

After treating corn with aldrin, carbaryl, diazinon, dieldrin, malathion, or Phosdrin, wait the number of days indicated below before harvesting or feeding the corn:

	<i>Days</i>
Aldrin, 2 ounces per acre.....	21
Aldrin, 4 ounces per acre.....	30
Carbaryl, 8 to 12 ounces per acre..	0
Diazinon, 8 to 12 ounces per acre..	2
Dieldrin, ½ to 2 ounces per acre....	40
Malathion, 12 to 16 ounces per acre..	5
Phosdrin, 4 to 8 ounces per acre....	1

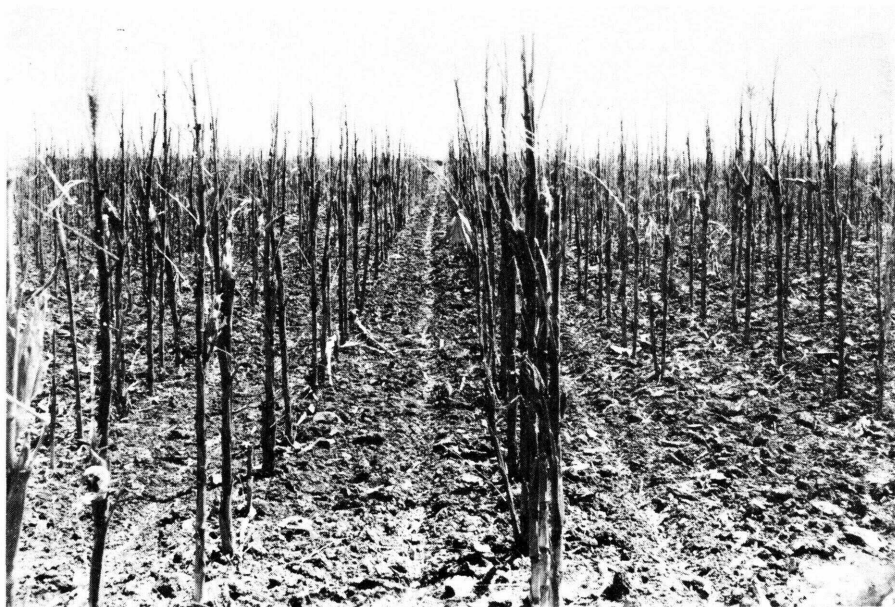
After treating small grains with aldrin or dieldrin, wait 7 days before harvesting the crop

if only the grain is to be fed. Wait 30 days if the straw is to be fed.

After treating small grains with malathion, wait 7 days before harvesting the crop; after treating with Phosdrin, wait 14 days. Do not use diazinon or carbaryl on small grains.

Alfalfa protection.—When an entire alfalfa field is severely infested, it usually is most economical to cut the alfalfa and then apply an insecticide to protect the next cutting. Spray or dust field margins, ditchbanks, patches of weeds, and uncultured strips of alfalfa where grasshoppers have concentrated.

Grasshoppers often hatch in large numbers after the first crop has been harvested. To control



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Grasshopper damage to tall corn. In severe outbreaks, stalks may be eaten to the ground.

these insects, spray or dust the next crop before the new growth is 6 inches high; this will protect the new growth.

Do not use the chlorinated hydrocarbon insecticides to control grasshoppers on alfalfa.

After treating alfalfa with naled, malathion, diazinon, or Phosdrin, wait the number of days indicated below before harvesting or feeding the alfalfa:

	Days
Naled	4
Malathion	7
Diazinon	7
Phosdrin	1

No waiting period is required for carbaryl. If you apply carbaryl, give advance notice to beekeepers whose bee yards are within or adjacent to the areas to be treated.

Range and pasture protection.—Grasshoppers on the range and pasture can be controlled more completely with sprays than with baits. Begin control measures when hatching of the dominant species is completed, and finish before the pests begin to lay eggs.

Do not allow dairy animals or animals being finished for slaughter to graze range areas treated with aldrin, chlordane, dieldrin, heptachlor, or toxaphene. Range that has been sprayed with the recommended dosages of aldrin or heptachlor may be safely grazed by meat animals after a waiting period of 90 days.

Do not apply toxaphene more than once a season. Do not graze meat animals in toxaphene-



BN-6520

Applying spray by airplane.

treated fields within 6 weeks of slaughter. Do not use toxaphene near lakes, streams, or ponds.

Range areas treated with malathion may be grazed after a waiting period of 5 days; those treated with Phosdrin may be grazed after 1 day. No waiting period is required for carbaryl.

Other areas.—Wastelands, roadsides, and conservation reserves that are not grazed by livestock may be treated with any of the recommended insecticides.

Treating these areas is important to hold down migrations. Protection of the current year's field crops and range forage is no longer the sole aim of grasshopper control. It has been demonstrated that if all infestations in a neighborhood are reduced to less than one grasshopper per square yard, further con-

trol measures will not be needed for several years unless the fields become reinfested through migrations.

Baits

A bait is prepared by mixing an insecticide with bran alone or with bran and sawdust. Use any of the insecticides listed below. In each 100 pounds of bran or bran and sawdust, mix enough of the formulation to provide the indicated amounts of active ingredient:

<i>Insecticide</i>	<i>Active ingredient</i>
Aldrin.....	2 ounces
Chlordane.....	½ pound
Heptachlor.....	4 ounces
Toxaphene.....	1 pound

Wet bait

A wet bait is used for application from the ground. To prepare it, stir an emulsifiable concentrate or wettable powder containing the insecticide into water, and mix with

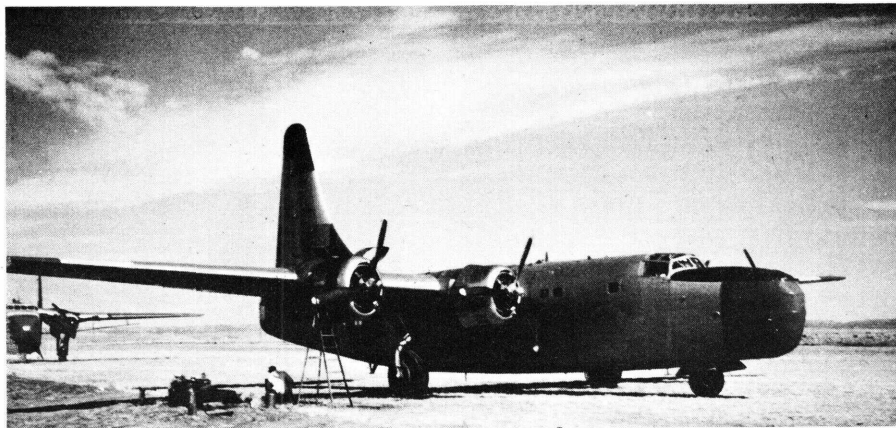
mill-run bran and sawdust in a single operation. To make 100 pounds of bait, use 25 pounds of bran, 3½ bushels of sawdust (3 times the volume of the bran), and enough water (10 to 12 gallons) to make a crumbly mash.

Spread the bait uniformly, by hand or with a broadcasting machine, at the rate of 20 pounds per acre.

Dry bait

A dry bait is preferable to a wet bait for application by aircraft. It can also be applied from the ground with single-outlet dusters. Do not apply dry bait with a broadcaster designed for handling wet bait.

A dry bait is made by impregnating bran with an oil solution of the insecticide. To prepare it, use enough oil solution to provide the recommended amount of active ingredient. Mix this with 2 quarts of kerosene or fuel oil. Spray this



BN-17624

U.S. Navy plane converted for spraying large range areas for grasshopper control. This plane can carry 2,500 gallons of spray and treat a strip 500 feet wide. Planes of other types are also used.

mixture onto 100 pounds of coarse, dry bran; power bait-mixing machines may be equipped with spraying devices for this purpose. Be careful to distribute the mixture uniformly throughout the bran.

Apply dry bait at the rate of 7 to 10 pounds per acre.

Dry bait may be prepared in advance and stored until needed.

PRECAUTIONS

All the insecticides recommended for grasshopper control are poisonous to man and animals. Handle them with care, and use them only when needed. Follow the directions and heed all precautions on container labels. Store insecticides in plainly marked containers away from all food products and in a dry place where children and animals cannot reach them.

When mixing or applying insecticides, avoid spilling them on the skin and keep them out of the mouth, nose, and eyes. If any is spilled on skin or clothing, wash it off the skin and change clothing immediately. If it gets in the eyes, flush them with plenty of water for 15 minutes and get medical attention.

The mention of commercial products in this publication does not constitute an endorsement by the U.S. Department of Agriculture over other products not mentioned.

Wash the face and hands thoroughly after applying any insecticide, and before smoking or eating. After long exposure to insecticide, bathe and change clothing. Wash clothing on which insecticide residues have accumulated before wearing it again.

If an insecticide is swallowed, induce vomiting by giving 1 tablespoonful of salt in a glass of warm water. Have the victim lie down and keep quiet. Call a physician immediately. If a person suddenly feels sick while using an insecticide or shortly afterwards, a physician should be called immediately. In all cases make available the pesticide container and any attached labeling.

Phosdrin is extremely poisonous and may be fatal if swallowed, inhaled, or absorbed through the skin. It should be applied only by a person thoroughly familiar with its hazards who will assume full responsibility for its safe use and who will comply with all precautions on the label. When applying Phosdrin, wear a respirator of a type that has been tested and found satisfactory by the U.S. Department of Agriculture. A list of acceptable respiratory protective devices may be obtained from the Entomology Research Division, Agricultural Research Service, Beltsville, Md.

Store bait where livestock cannot reach it. Do not pile it on the ground. Keep livestock off airstrips where aircraft is being loaded

with bait. In loading aircraft, spill as little bait as possible, and clean up all that is spilled on the strips or in adjacent grass or brush.

To protect fish and wildlife, do not contaminate streams, lakes, or ponds with insecticides. Do not clean spraying equipment or dump excess spray material near such water.

To avoid killing bees, do not apply insecticide to legumes when they are in bloom. If grasshoppers must be controlled at this time to save the seed crop, apply one of the organophosphate sprays, and do this only during hours when the bees are not visiting the plants. Avoid drift of insecticide into bee yards or adjacent crops in bloom. Sprays are less harmful to bees than are dusts.

Avoid drift of sprays or dusts to nearby crops or livestock, especially from applications by aircraft or other power equipment. Do not allow poultry, dairy animals, or meat animals to feed on plants or drink water contaminated by drift of insecticide.

CULTURAL PRACTICES

Grasshoppers, particularly those that lay their eggs within cropped fields, may be controlled to some extent by tillage and seeding operations and by other cultural measures. Use these measures only if they are consistent with approved farming practices in your community.

Cultural operations do not eliminate the necessity of using insecticides, but they reduce the quantity of chemicals needed and make their application easier.

Tillage

Working the soil kills grasshoppers in several ways. It may bury their eggs so deep that the young grasshoppers do not hatch. It may bring the eggs to the surface where they are destroyed by the drying action of sun and wind. It is also a means of discouraging egg laying, preventing dispersal of the pests, and forcing grasshoppers scattered over a field to concentrate in a small area.

Proper tillage before eggs have hatched often gives excellent control of light or threatening grain-stubble infestations.

Fall tillage is preferable, but spring tillage is sometimes just as effective. Tillage right after harvest will make the soil unattractive to egg-laying females, and will assist in destroying eggs already laid.

In determining the time of tillage and the implement to use, you should consider not only grasshopper control but also the tillage effect on soil drift, weed control, and soil moisture.

Moldboard plowing, 5 or more inches deep, followed by packing, is the best method of preventing the emergence of young grasshoppers in districts where soils are heavy and soil blowing is not a problem.

Shallow cultivation is less effective than moldboard plowing, but

it will destroy many of the eggs by exposing them to sun and wind. The one-way disk is the best implement for this operation. The duck-foot cultivator, the single or double harrow, and the one-way disk harrow, are satisfactory. "Blade" tillers used in "stubble-mulch" farming are less effective than the others. Shallow cultivation is most effective during dry weather, when the egg-drying effects of sun and wind are greatest.

Grasshopper-infested grain stubble that is to be summer-fallowed should be worked before the eggs hatch. If tillage is delayed until after the young grasshoppers appear, it still can be used to prevent them from moving to nearby crops. This tillage can be accomplished by cultivating a guard strip 3 rods wide around the entire field. If the strip is kept cleanly fallowed, the young grasshoppers can usually be held within the field for a week or two. There may be time to complete tillage operations before they escape.

Tillage done after the establishment of the guard strip should start next to the strip and should extend until only a small block of unworked stubble remains in the center of the field. The grasshoppers will then be concentrated in this small area. They can be killed with insecticide at much less expense than would be required for spraying or dusting the entire field.

Do not plow or shallow-till large tracts of sod or idle land to control grasshoppers unless you intend to

seed or summer-fallow the land immediately. Cultivation ruins such land for pasture and makes it subject to soil blowing.

Seeding

In years when grasshoppers are abundant, small grains should be planted only on fall- or spring-tilled land, or on clean summer-fallowed land. Few grasshoppers will emerge from such land.

Do not drill grain into heavily infested, unworked stubble. You will destroy only a few eggs by the seeding process. When the eggs hatch, the field will swarm with young grasshoppers. Immediate spraying or dusting of the entire field will then be necessary to save the crop.

Early spring seeding is an important factor in reducing grasshopper damage. Early-seeded crops make considerable growth before grasshoppers hatch. They withstand a longer period of feeding than late-seeded crops. They give the grower a better opportunity to kill the grasshoppers with chemicals.

When small grains are ripening, flying grasshoppers frequently congregate in late-seeded crops that are still green and succulent. Those crops are often severely damaged before the grasshoppers are noticed. Well-advanced crops are much less attractive to the pests. Barley, oats, and wheat that have headed can withstand considerable defoliation without serious reduction in yield of grain.

Other Measures

Insecticides and proper tillage and seeding are the best weapons for fighting grasshoppers, but occasionally you may be able to combat the pests in other ways.

Regrassing field margins

Studies in the northern Great Plains have shown that weedy margins, including roadsides and fence rows, contain more grasshopper eggs than other habitats. Replacing broad-leaved weeds with perennial grasses greatly reduces the number of grasshoppers in these locations. Crested wheatgrass can be used for this purpose. It is easily and quickly established and is even less attractive for egg laying than native grasses.

Elimination of weeds and prevention of soil erosion are additional benefits of grassed field margins.

Increased farm returns derived from the grass grown along otherwise unproductive field margins may also be of some importance.

Immune crops

Some of the sorghums such as sorgo and kafir, after reaching a height of 8 to 10 inches, are practically immune to grasshopper attack. They can be planted rather late in the season to provide valuable feed for livestock.

Irrigation

When alfalfa and other legumes are irrigated, large numbers of grasshoppers are sometimes driven to ditchbanks and other dry places where they can be killed with spray or dust at slight expense. Flooding hay meadows where grasshopper eggs have recently hatched will destroy many of the young grasshoppers.

This bulletin and the Agriculture Information Bulletin entitled, "Grasshoppers: Their Habits and Damage" supersede Farmers' Bulletin 2064, "Grasshoppers—A New Look at an Ancient Enemy."

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